

## In-Space Friction Stir Welding Machine, Phase I

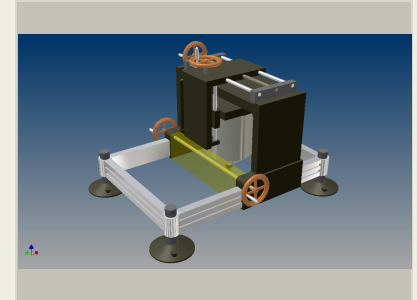
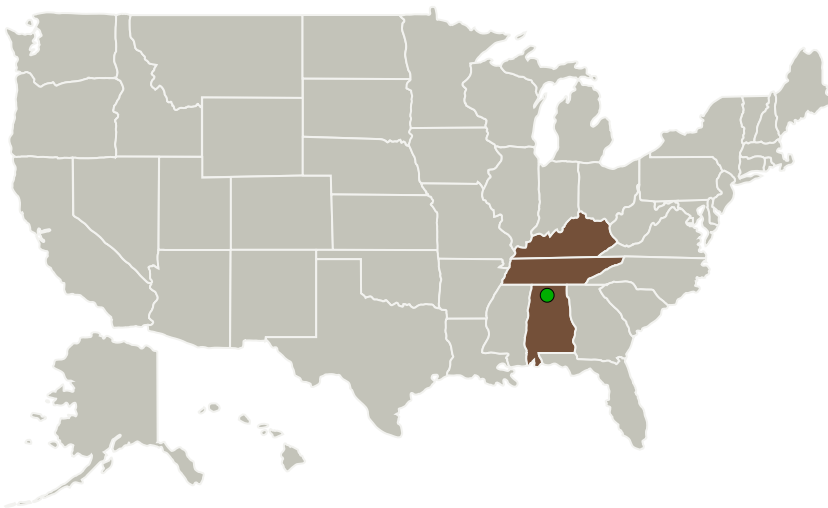
Completed Technology Project (2013 - 2014)



## Project Introduction

Longhurst Engineering, PLC, and Vanderbilt University propose an in-space friction stir welding (FSW) machine for joining complex structural aluminum components. The proposed FSW machine is innovative because it can be deployed by 2 people and be used to weld complex surfaces that extend beyond linear welding applications. The in-space FSW machine is a 3 axis system that can be mounted to work pieces of varying geometry, position, and orientation through the use of a high performance vacuum system or mechanical clamps. The key enabler of the proposed FSW machine is a self adjusting and self aligning FSW (SAA-FSW) tool that eliminates the need for automated actuators. In addition, a collection of force reduction techniques will be included as part of the system. When combined together, it is theorized that the effect will be significant and will lead to the advancement of FSW by reducing structural rigidity requirements of FSW machines. Our work plan begins by determining the net effect of the combined force reduction techniques. Substantial effort is given to the development of a preliminary SAA-FSW tool which includes experimental welding. Lastly, a preliminary set of engineering plans will be delivered based upon the results from the development of the SAA-FSW tool and force reduction techniques.

## Primary U.S. Work Locations and Key Partners



In-Space Friction Stir Welding Machine

## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

## In-Space Friction Stir Welding Machine, Phase I

Completed Technology Project (2013 - 2014)



Organizations Performing Work	Role	Type	Location
Longhurst Engineering, PLC	Lead Organization	Industry	Guthrie, Kentucky
● Marshall Space Flight Center (MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama
Vanderbilt University	Supporting Organization	Academia	Nashville, Tennessee

## Primary U.S. Work Locations

Alabama	Kentucky
Tennessee	

## Project Transitions

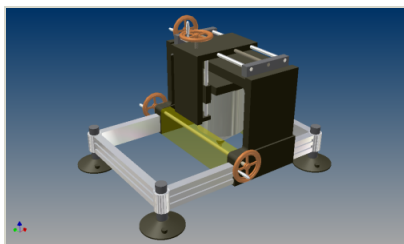
▶ **May 2013:** Project Start

✓ **May 2014:** Closed out

## Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138639>)

## Images



## Project Image

In-Space Friction Stir Welding Machine

(<https://techport.nasa.gov/image/129634>)

## Organizational Responsibility

## Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

## Lead Organization:

Longhurst Engineering, PLC

## Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

## Program Director:

Jason L Kessler

## Program Manager:

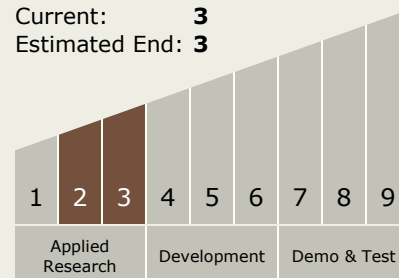
Carlos Torrez

## Principal Investigator:

George E Cook

## Technology Maturity (TRL)

Start: 2  
Current: 3  
Estimated End: 3



# In-Space Friction Stir Welding Machine, Phase I

Completed Technology Project (2013 - 2014)



## Technology Areas

### Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - └ TX12.1 Materials
    - └ TX12.1.1 Lightweight Structural Materials

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System